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ABSTRACT*

MAN INDUCED EROSION OF PERMAFROST

by

Robert Lewellen and Jerry Brown**

The activity of man in the Barrow, Alaska vicinity has inadvertently accelerated the erosion of permafrost. Footprint Creek is rapidly entrenching as a result of draining three large lakes. The draining of two lakes increased the drainage area four-fold. The draining of the third lake established a new erosional base level for the creek. Sequential aerial photography taken from 1945 through 1968 has been utilized to reconstruct the geomorphic processes. Ground measurements and observations were made. The record precipitation, in 1963, resulted in a knickpoint retreat of twenty-eight meters due to the thermal erosion of high-ice content, fine-grained sediments. A snow road, constructed in the winter of 1963 and 1964, was effective in temporarily damming the runoff waters. These waters caused extensive thermal erosion. During the summer of 1964, water-hauling vehicles destroyed the tundra adjacent to the lower Footprint Creek channel. Gullies are developing along the vehicle tracks.

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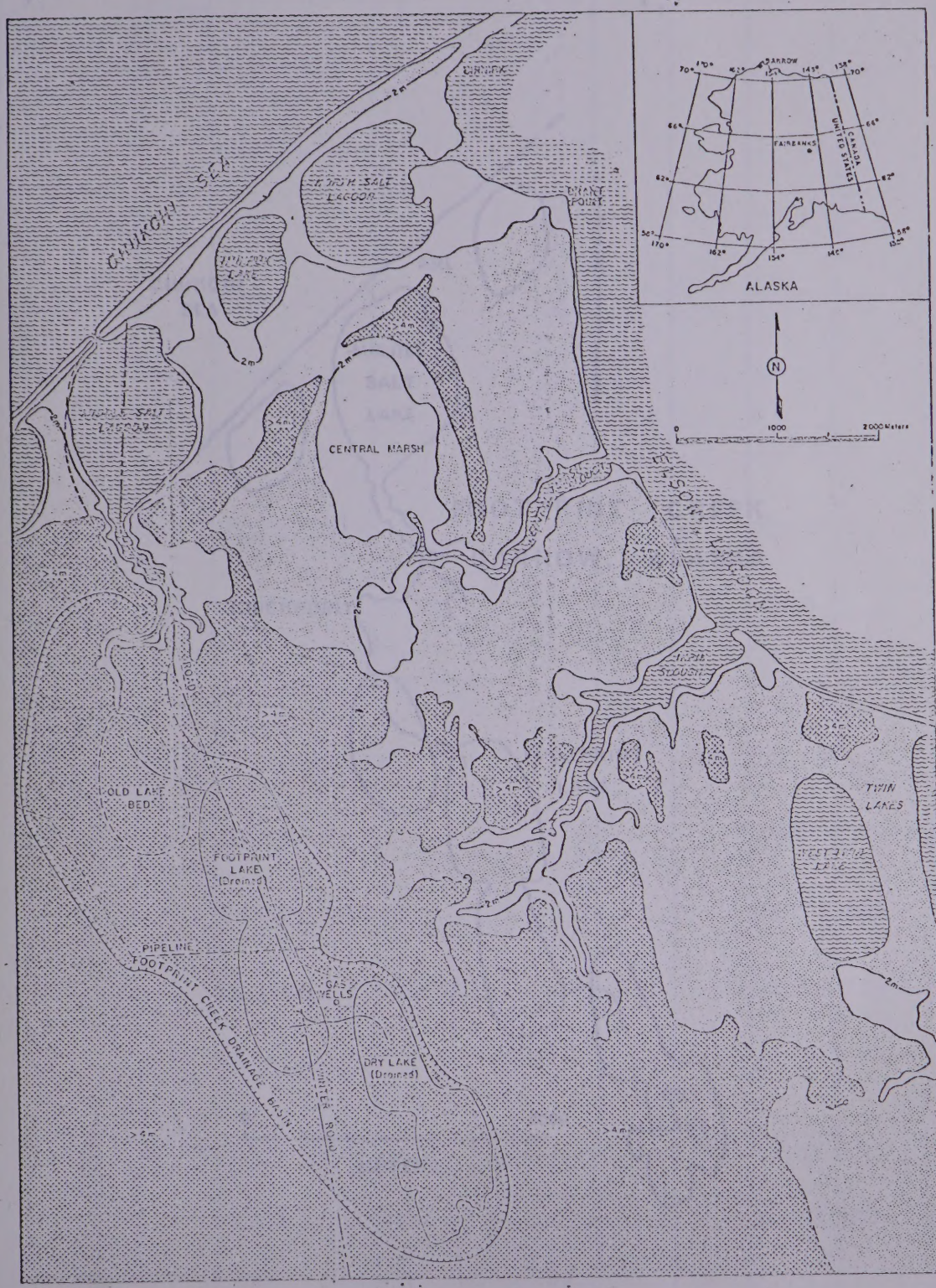
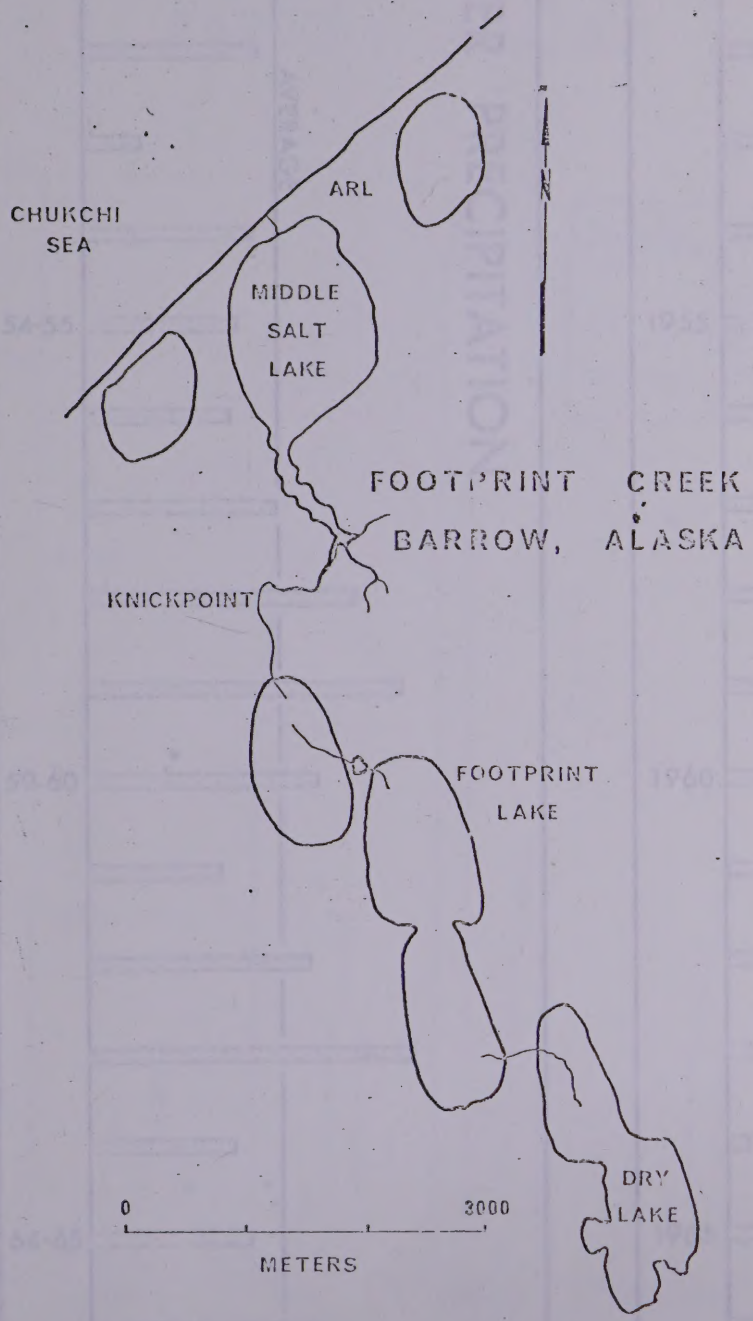
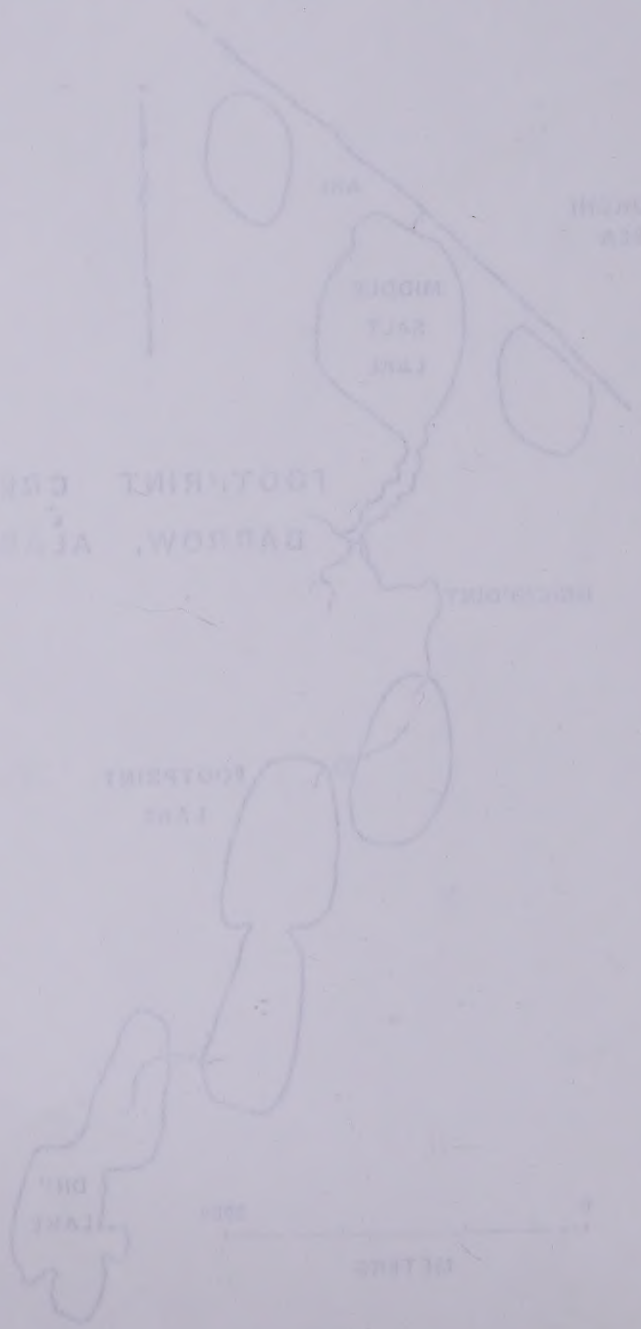
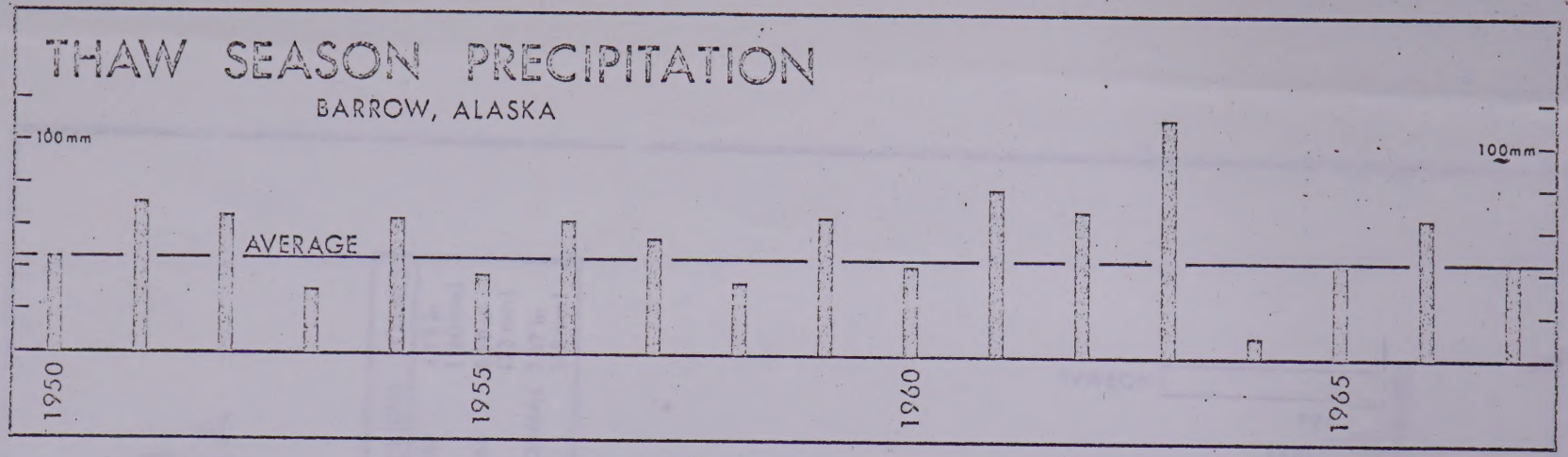
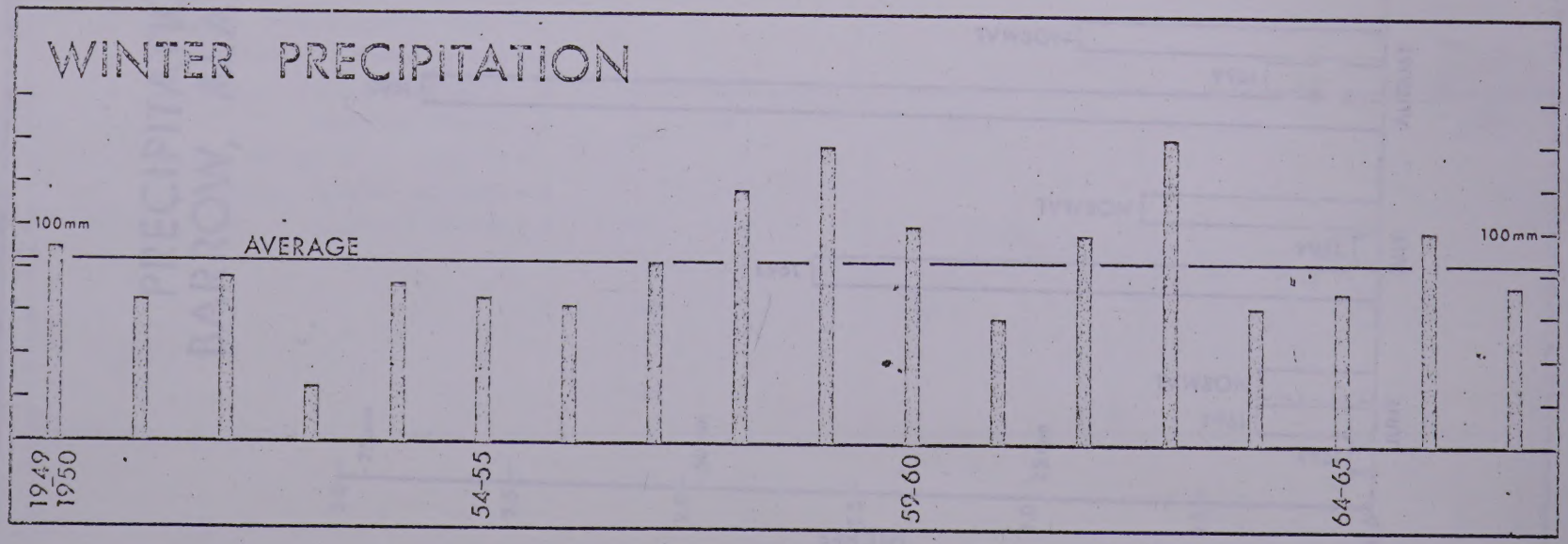

BARROW
FAIRBANKS
CANADA
UNITED STATES
ALASKA
N
0
1000
2000 Meters
BEAUFORT SEA
ELSON LAGOON
PEARD BAY
WAINWRIGHT
POINT
2m
4m
>4m
CENTRAL MARSH
WAINWRIGHT
SLOUGH
OLD LAKE
BED
FOOTPRINT
LAKE
(Drained)
PIPELINE
FOOTPRINT CREEK DRAINAGE BASIN
GAS
WELLS
DRY LAKE
(Drained)
TWIN
LAKES
WESTERN
LAKE


CHUKCHI
SEA
ARL
MIDDLE
SALT
LAKE
N
FOOTPRINT CREEK
BARROW, ALASKA
KNICKPOINT
FOOTPRINT
LAKE
DRY
LAKE
0
3000
METERS

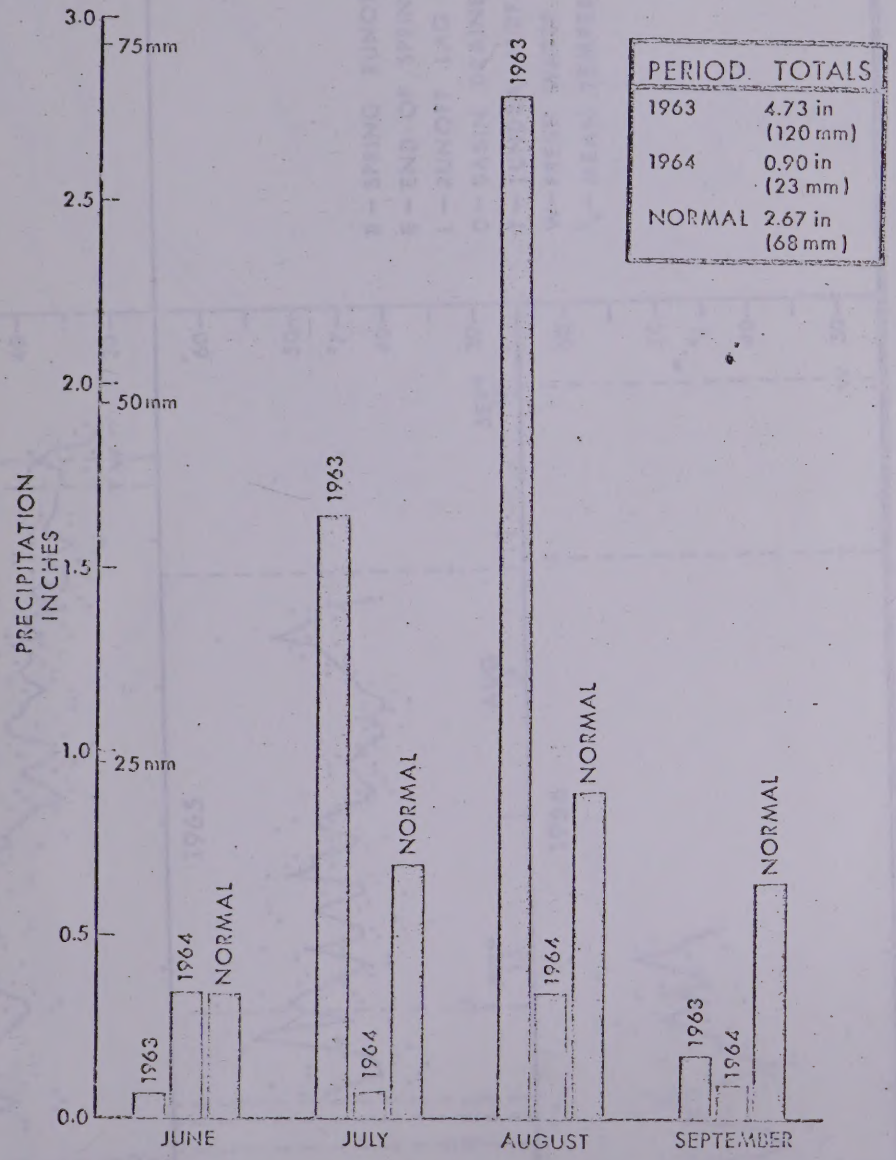


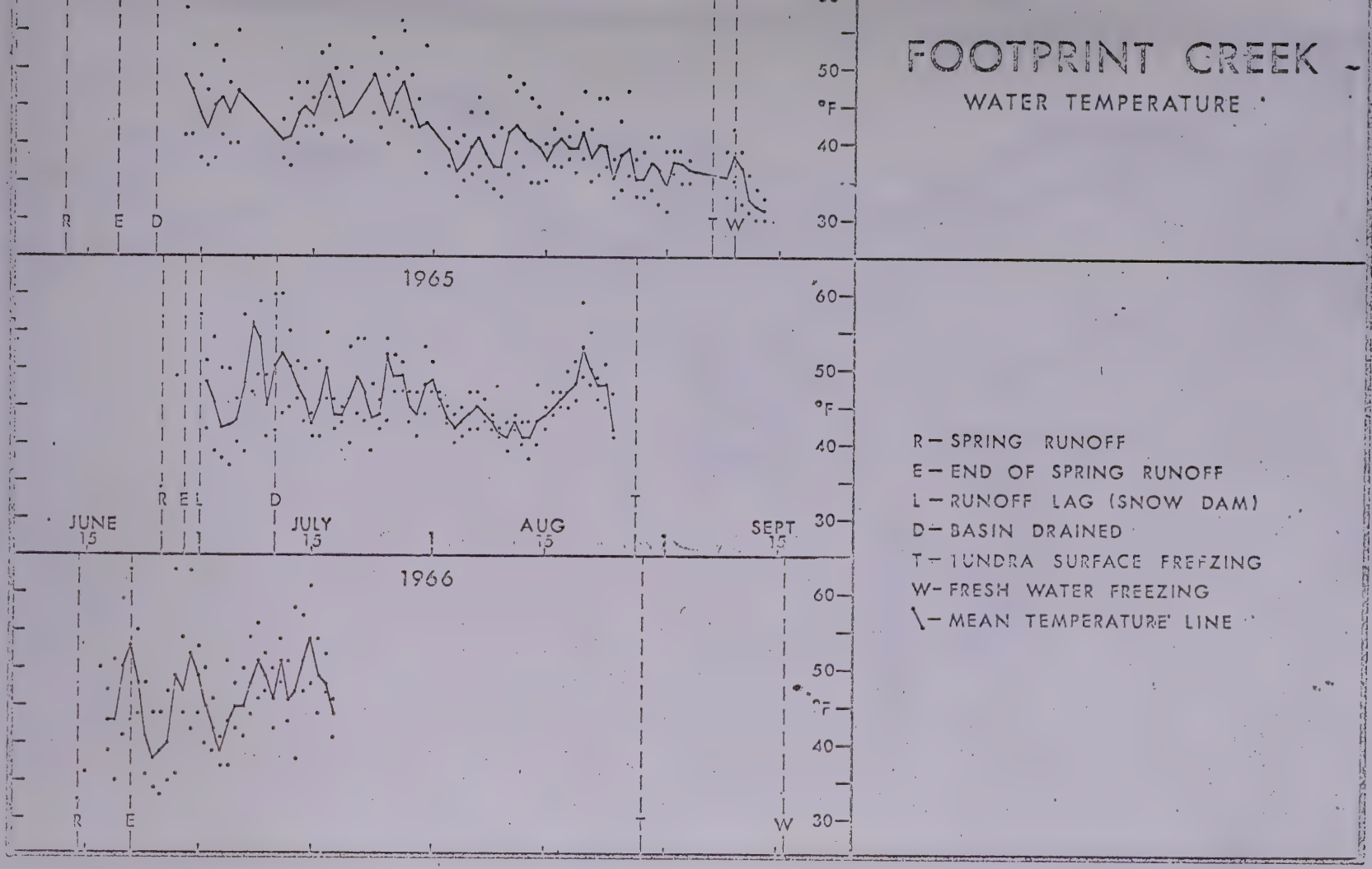

THAW SEASON PRECIPITATION
BARROW, ALASKA
100mm
AVERAGE
100mm
1950
1955
1960
1965

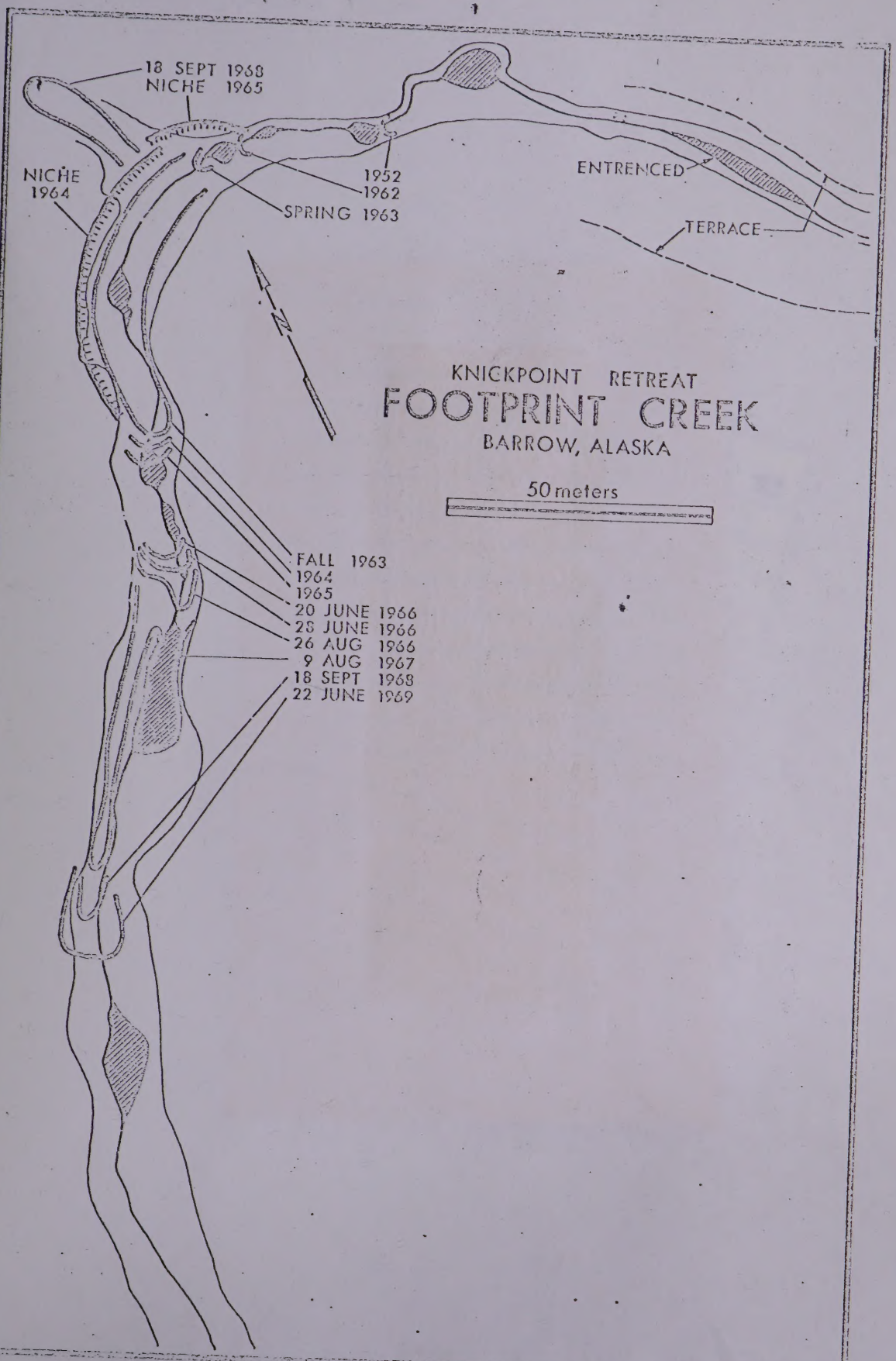

WINTER PRECIPITATION
100mm
AVERAGE
100mm
1949
1950
54-55
59-60
64-65

VOLITAJSKA SETNJA

PRECIPITATION
BARROW, ALASKA




FOOTPRINT CREEK
WATER TEMPERATURE
1965
1966
JUNE 15
JULY 15
AUG 15
SEPT 15
60
50
40
30
°F
R
E
L
D
T
W
R — SPRING RUNOFF
E — END OF SPRING RUNOFF
L — RUNOFF LAG (SNOW DAM)
D — BASIN DRAINED
T — TUNDRA SURFACE FREEZING
W — FRESH WATER FREEZING
\ — MEAN TEMPERATURE LINE


18 SEPT 1968
NICHE 1965
NICHE
1964
1952
1962
SPRING 1963
ENTRENCED
TERRACE
KNICKPOINT RETREAT
FOOTPRINT CREEK
BARROW, ALASKA
50 meters
FALL 1963
1964
1965
20 JUNE 1966
28 JUNE 1966
26 AUG 1966
9 AUG 1967
18 SEPT 1968
22 JUNE 1969

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